25. The system of claim 24 wherein at least one of said periodically spaced frequency domain symbols carries data.

REMARKS

Claims 1-25 have been examined and rejected. It is noted with appreciation that claims 4-8 and 17-21 have been indicated to be directed towards allowable subject matter. The present response amends claims 1, 3, 5, 8-14, 16-17, 19-22, and 24. Accordingly, claims 1-25 remain pending. Reconsideration and allowance of all pending claims are respectfully requested.

Informality in Specification

The application has been amended to correct the status of the co-filed application. Since this correction has been made, the objection should be withdrawn.

Claim Objections

Claims 3, 8, 9, 11, 14, 16, 22, and 24 have been objected to for various informalities. The objected to claims have been amended appropriately in response, thereby overcoming these objections.

Claim 10 has been objected to as improperly depending from claim 11. The present response amends claim 10 to depend from claim 9 rather than claim 11. This objection is therefore also overcome and should be withdrawn.

Rejection of Claims 1, 3-10, 12-13, and 16-25 under 35 U.S.C. §112, second paragraph

The Examiner has pointed to various concerns many of which relate to antecedent basis. In response, the rejected claims have been amended for the purpose of clarification.

However, there are two points of rejection which are respectfully traversed. The rejection asserts that the term "the time domain" in claim 3, lines 2-3, claim 16, line 3 lacks clear antecedent basis. It is respectfully submitted that in the phrase "the time domain" it is clearly understood by those familiar with signal processing terminology that "the" does not refer to an earlier mention of "time domain" but merely represents a colloquial phrasing. Substituting "a time domain" or just "time domain" would be inconsistent with generally accepted usage for this term.

The rejection asserts that claim 13, line 2, is unclear in reciting "a transmission stage." The rejection further asserts that it is not clear as to whether this recites "a second transmission stage" or "said transmission stage" referring back to claim 12, line 3. Referring back to the undersigned's copy of originally filed claim 12, the limitation that appears at line 3 is in actuality "a transforming stage." There is therefore no inconsistency between the recitation of claim 13 and claim 12 and this aspect of the rejection should be withdrawn.

Rejections under 35 U.S.C. §102

Claims 1, 2, and 12-15 have been rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,381,251 issued to Sano, et al. It is respectfully submitted that the Sano, et al. reference is inapplicable to the rejected claims both because the priority date of the present application precedes the filing date of the Sano, et al. patent for many of them, and further because the rejected claims recite systems and methods for synchronization that are completely different from what is described in Sano, et al.

Of the rejected claims, at least claims 1-2 and 12-14 are completely supported by provisional application No. 60/074,331, filed on February 6, 1998 from which the present application claims priority. As the filing date of this provisional application precedes the filing date of the Sano, et al. reference, it is inapplicable as prior art to at least these identified claims. ?

Furthermore, the present application describes and claims OFDM synchronization techniques completely different from what is described in Sano, et al. Sano, et al. describes

synchronization technique employing a signal structure (shown in Fig. 16) that incorporates two specialized synchronization wave forms. As described in column 5, lines 20-40, one of the synchronization wave forms is a null signal and the other synchronization signal is a sweep signal. Lines 10-24 of column 5, clarify that these synchronization wave forms are combined with data to be transmitted in the time domain since the integration of the synchronization and data signals occurs after the use of the inverse Fourier transform. As will be explained with reference to the rejected claims more specifically, this disclosed synchronization scheme is irrelevant to the present invention.

Claim 1 recites the use of a "cyclic prefix" for synchronization. More specifically a "second portion" is included in the cyclic prefix to facilitate receiver synchronization. A mathematical definition of cyclic prefix is presented at the bottom of page 7 of the present application. Essentially, the use of a cyclic prefix involves appending a copy of a certain number of final samples of an OFDM burst to the burst's beginning. Embodiments of the present invention involve extending the cyclic prefix for the purpose of synchronization.

The rejection's assertion that this type of cyclic prefix is found in the Sano, et al. reference is not understood. There is simply no identification of signal structure constituting a cyclic prefix. This is sufficient reason for the allowability of claim 1, and also of claim 12 which recites a similar cyclic prefix structure.

Claim 2 is directed toward a method for transmitting an OFDM signal to facilitate receiver synchronization. Claim 2 more specifically recites the use of a frequency domain burst having periodically spaced non-zero frequency domain symbols with null energy symbols in between. The recited burst thus has a particular frequency domain structure. This structure is neither disclosed nor suggested anywhere in the Sano, et al. reference. The rejection cites column 1, lines 44-50 as disclosing the recited frequency domain burst structure. However, review of this section shows that it merely points to a null synchronization waveform that is interspersed with data and the other synchronization waveform in the **time domain**. This is in no way comparable to the recited **frequency domain** structure of claim 2. Claim 2 is therefore also

allowable over the art of record. Claim 14 recites a similar frequency domain structure and is therefore also allowable.

Claim 13 is allowable for at least the reason of its dependence from allowable claim 12. Furthermore there is no disclosure or suggestion of "a transmission stage that transmit said burst of time domain symbols with said appended cyclic prefix" because there is no disclosure or suggestion of such an appended cyclic prefix. Claim 15 is allowable for at least the reason of its dependence from claim 14. Furthermore, the rejection does not identify text corresponding to the recitation that "at least one of said periodically spaced frequency domain symbols carries data." This is further reason for the allowability of claim 15.

Rejections Under 35 U.S.C. §103(a)

Claims 3, 9-11, 16, and 22-25 have been rejected under 35 U.S.C. §103(a) as being obvious over Sano, et al. in view of U.S. Patent No. 6,275,543, issued to Petrus, et al. It is respectfully submitted that the cited art is inapplicable to the rejected claims and that this rejection should therefore be withdrawn. As a preliminary issue, at least claims 3, 9-11, 16, and 22-24 are fully supported by the provisional application noted above from which the present application claims priority. Therefore, the Sano, et al. reference cannot be applied properly to these claims, thus removing a key basis for the rejection. Furthermore, the deficiencies in the Sano, et al. reference noted above in relation to the claims rejected on §102(e) grounds are also relevant in considering the claims rejected under §103. The Petrus, et al. reference remedies none of the deficiencies of the Sano, et al. reference.

Distinctions between the rejected claims and cited art will now be analyzed on a claim by claim basis. Claims 3 and 16, for example, recite a supplemental cyclic prefix similar to that recited in claim 1. As is discussed with reference to claim 1, the Sano, et al. reference neither discloses nor suggests such a cyclic prefix structure and such a structure is also not found in the Petrus, et al. reference. Since all the recited features of claims 3 and 16 have therefore not been identified in the cited art, there is no *prima facie* case of obviousness and thus no basis for an obviousness rejection.

Claims 9, 11, 22, and 24, identify a frequency domain burst structure similar to that recited in claim 2. As was pointed out in reference to claim 2, the Sano, et al. reference does not disclose or suggest this frequency domain burst structure. The Petrus, et al. reference again fails to remedy the deficiencies of Sano, et al. Thus, also as to these independent claims 9, 11, 22, and 24 there is no effective *prima facie* case of obviousness. Referring now to the dependent claims 10, 23 and 25, these claims are allowable for at the least the reason of the dependence from their parent allowable claims. Furthermore, the features recited by these dependent claims are not disclosed or suggested by the art of record, further reason for their allowability.

In summary, it should be noted that the differences between the invention as recited by the pending claims and the cited art are extremely great. The distinctions mentioned in the above analysis are merely representative examples of the inapplicability of these references to the present claims.

Conclusion

For the foregoing reasons, Applicant believes all the pending claims are in condition for allowance and should be passed to issue. If the Examiner feels that a telephone conference would in any way expedite the prosecution of the application, please do not hesitate to call the undersigned at (408) 446-8694.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE APPLICATION

In the Specification

The present application is related to the subject matter of U.S. App. No. **[-------, (Attorney Docket No. CISCP625)]**, 09/244,754, filed February 5, 1999, entitled ENHANCED SYNCHRONIZATION BURST FOR OFDM SYSTEMS, co-filed and co-assigned with the present application.

In the Claims

1. (Amended) A method for transmitting an OFDM signal via a channel to facilitate receiver synchronization comprising:

transforming a series of frequency domain data symbols into a burst of time domain symbols;

appending to a beginning of said time domain burst a cyclic prefix duplicating a last segment of said time domain burst, wherein said cyclic prefix includes a first portion having length ν wherein ν is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization; and

transmitting said **[data]** time domain burst with said appended cyclic prefix.

3. (Amended) A method for synchronizing to **[a received]** an OFDM signal received via a channel, said method comprising:

receiving successive OFDM bursts wherein each of said successive OFDM bursts includes in the time domain, a series of N time domain symbols, a cyclic prefix duplicating a last segment of said series of N time domain symbols, wherein said cyclic prefix includes a first portion having length ν wherein ν is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization;

evaluating a first cost function over said successive OFDM bursts that varies depending on receiver burst timing alignment to said successive OFDM bursts; and

setting said burst timing alignment to optimize said first cost function, thereby synchronizing receiver burst timing to transmitter burst timing.

5. (Amended) The method of claim 3 wherein said **[first portion of]** length ν **[said cyclic prefix has]** is initially unknown **[length]**, said first cost function varies depending on said length ν and said setting step further varies said **[cyclic prefix]** length ν of said cyclic prefix to optimize said first cost function.

8. (Amended) The method of claim 7 wherein each of said successive OFDM bursts include frequency domain training symbols at predetermined positions and having predetermined values; and further comprising:

setting **[said]** an integer component of said receiver frequency alignment so that said frequency domain training symbols are received at their predetermined positions.

9. (Amended) A method for synchronizing a receiver to an OFDM signal comprising:

receiving at least one synchronization OFDM burst wherein periodically spaced frequency domain symbols of said **[bursts]** <u>at least one synchronization OFDM burst</u> have predetermined values and tones between said **[periodically spaced]** periodically spaced frequency domain symbols have null energy;

evaluating a first cost function that varies depending on burst timing alignment, said first cost function measuring time domain periodicity of said synchronization OFDM burst; and

setting said burst timing alignment to optimize said first cost function.

10. (Amended) The method of claim **[11]** <u>9</u> further comprising

computing a receiver frequency offset based on said burst timing alignment as optimized by **[said setting step]** <u>setting said burst timing alignment to optimize said first cost function</u>.

11. (Amended) A method for synchronizing a receiver to an OFDM signal comprising:

receiving at least one OFDM synchronization burst wherein periodically spaced frequency domain symbols of said <u>at least one OFDM synchronization</u> burst have values including non-zero values and frequency domain symbols between said periodically spaced frequency domain symbols have null energy; and

determining burst timing alignment and frequency offset responsive to optimization of cost functions determined in response to contents of said at least one OFDM synchronization burst.

12. (Amended) A system for transmitting an OFDM signal via a channel to facilitate receiver synchronization comprising:

a transforming stage that transforms a series of frequency domain data symbols into a burst of time domain symbols; and

a cyclic prefix appending stage that appends to a beginning of said **[time domain]** burst <u>of time domain symbols,</u> a cyclic prefix duplicating a last segment of said **[time domain]** burst, wherein said cyclic prefix includes a first portion having length ν wherein ν is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization.

13. (Amended) The system of claim 12 further comprising:

a transmission stage that transmits said **[data]** burst <u>of time domain symbols</u> with said appended cyclic prefix.

14. (Amended) A system for transmitting an OFDM signal to facilitate receiver synchronization comprising:

a synchronization burst generation stage that develops a frequency domain burst wherein periodically spaced frequency domain symbols of said <u>frequency domain</u> burst have values including non-zero values and frequency domain symbols between said periodically spaced frequency domain symbols have null energy; and

a transform processing stage that transforms said frequency domain burst into a time domain burst.

16. (Amended) A system for **[synchronizing to a received]** <u>processing an</u> OFDM signal comprising:

an OFDM reception system that receives <u>successive</u> OFDM bursts wherein each of said <u>successive OFDM</u> bursts includes in the time domain, a series of N time domain symbols, a cyclic prefix duplicating a last segment of said series of N time domain symbols, wherein said cyclic prefix includes a first portion having length ν wherein ν is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization; and

a synchronization **[system]** block that evaluates a first cost function over said successive OFDM bursts that varies depending on receiver burst timing alignment to said successive OFDM bursts; and that sets said burst timing alignment to optimize said first cost function, thereby synchronizing receiver burst timing to transmitter burst timing.

17. (Amended) The system of claim 16 wherein said first cost function evaluates degree of match between said second portion of said cyclic prefix and a corresponding portion of said N time domain symbols.

19. (Amended) The system of claim 16 wherein said synchronization **[system]** block determines optimal burst timing that will be optimal for all channel impulse response durations up to said length ν of said first portion of said cyclic prefix.

20. (Amended) The system of claim 16 wherein said synchronization **[system]** block determines a fractional component of a receiver frequency alignment as measured in a unit defined by spectral width of a single OFDM frequency domain symbol based on said burst timing alignment as varied to optimize said first cost function and on a second cost function that varies according to frequency alignment.

21. (Amended) The system of claim **[19]** 20 wherein each of said OFDM bursts include frequency domain training symbols at predetermined positions and having predetermined values; and wherein said synchronization **[system]** block sets **[said]** an integer component of said receiver frequency alignment so that said frequency domain training symbols are received at their predetermined positions.

22. (Amended) A system for **[synchronizing a receiver to an]** processing an OFDM signal comprising:

an OFDM receiver system that receives at least one synchronization OFDM burst wherein periodically spaced tones of said at least one synchronization OFDM burst have values including non-zero values and tones between said periodically spaced tones have null energy; and

a synchronization **[system]** block that evaluates a first cost function that varies depending on burst timing alignment, said first cost function measuring periodicity of said synchronization OFDM burst; and

wherein said synchronization **[system]** block sets said burst timing alignment to optimize said first cost function.

24. (Amended) A system for **[synchronizing a receiver to an]** processing an OFDM signal comprising:

an OFDM receiver system that receives at least one OFDM synchronization burst wherein periodically spaced frequency domain symbols of said burst have values including non-zero values and frequency domain symbols between said periodically spaced frequency domain symbols have null energy; and

a synchronization **[system]** block that determines burst timing alignment and frequency offset responsive to optimization of cost functions determined in response to contents of said at least one OFDM synchronization burst.